Story of Weights and Measures

Purpose

The purpose of this series of lessons is for students to learn the history of weights and measures and how they are used.

Time*

Reading 'The Story of Weights and Measures'
One 40-minute session

How Many Cubits Are You?
One 30-minute classroom activity

Story of Weights and Measures Review
Homework

**Time for the lessons will vary depending on how many activities you perform and how you use this information in the classroom.*

Materials

For each student:

- *The Story of Weights and Measures Review*
  Student Worksheet
  Copy of the text
- *How Many Cubits Are You?*
  Cubits Chart
- Pencil
- Tape Measure

Introduction

From the earliest times people have exhibited an interest in the measurement of the world around them. Many of the measurements we use today were invented by the Egyptians several thousands of years ago and were based on different parts of the body.

This series of lessons will introduce the student to the history of weights and measures and take the student from Egyptian times to weights and measures in California today. The lesson emphasizes the purpose and need for standards of measurement and their role in everyday life.

Students are provided information to help them explore the history of weights and measures and discover the different units of measure as they evolved.

As you use the attached lessons, it is important for the students to understand what weights and measures are and how they are used.

Procedure

1. Review the materials and revise them to meet the needs of your students.

2. Introduce your students to the lesson by explaining the reason we have weights and measures standards. Tell them that we can measure lengths in units such as inches, feet, meters, etc. By using standard units that everyone knows, we can agree what a certain length means. But long ago, people measured with parts of their bodies, their feet or hands!

    - What kinds of problems do you think they had using different parts of the body?
    - How do we use measurement today?
    - After reading the story, conduct a classroom discussion. What was the most interesting thing they learned?

STORY OF WEIGHTS AND MEASURES

INTRODUCTION

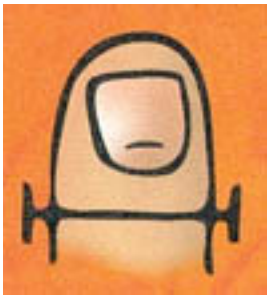
Try to imagine your life with no standard system of measurement. You would have no way to determine how tall you are, how much you weigh or how far you have to travel to school. You would not know what clothes to wear on a summer day because there would be no way to measure the temperature. If you were sick, doctors would have no way to measure medicine to help you get well.

As you can see, measurement is, and has always been, a very important part of our everyday life. We measure how much, how far, how long, wide, deep, cold or how much we are getting for the money we spend. Everything in the world is weighed, measured or counted.

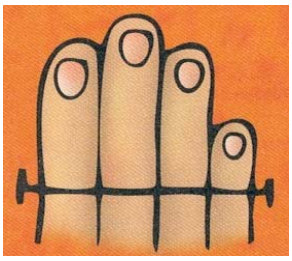
To learn more about the world of measurement, let's travel back in time to the land of Egypt.

EARLY HISTORY

Even in the earliest times, people had ways of measuring. Many of our **units** were invented by the Egyptians several thousands of years ago. Early unit of measure came from parts of the body and people's surroundings. The **foot** unit was the length of an adult human foot. Three grains of barley placed end to end made one finger, or **digit**.



The width of one finger was a **digit**



The width of four fingers was a **palm**

Open your hand and stretch out your fingers. The distance from the tip of your thumb to the end of your little finger was a **span**. Now bend your arm. The distance from your elbow to the tip of your middle finger was a **cubit**.

But as civilizations grew, these ways of measuring were not adequate anymore. How could a foot be used as a measure when one person's foot was so much longer than another's? Hands and fingers were different sizes too.

The ancient Egyptians knew the importance of agreeing on a standard length for a **pace**, or standard units of **volume** and weight. But whose arm, hand or foot would be used as the **standard**? It was decided that the king or queen in power would become the official standard. This was not a good solution because the standard would change every time a new king or queen came to power.

Egyptian units of measure based on parts of the body were spread by traders of the eastern Mediterranean Sea, to the Greek cities, later to Rome, then into Europe of the Middle Ages, and through England to the United States.

ENTER THE METRIC SYSTEM

The English finally agreed to a standard length of the **yard** unit using the length of Queen Elizabeth I's arm. By 1592 most of the English units of measure had been given standards that everyone agreed to use.

While the English used their old units based on parts of the body, the French invented new units. Their basic unit was the unit of length called the **meter**. It was figured as one ten-millionth of the distance from the North Pole to the equator.

They marked the distance of one meter (equal to 39.37 inches) onto a metal bar and made this the master meter stick. Since everyone agreed that the length of a meter is exactly the same as the distance marked on this bar, this is what a standard is. It is something everyone agrees to.

All metric measures of length and distance are based on the meter and the number 10.

<u>The meter is the basic unit of measure.</u>	<u>There are units smaller than a meter too.</u>
10 meters are 1 dekameter	1/10 of a meter is a decimeter
100 meters are 1 hectometer	1/100 of a meter is a centimeter
1000 meters are 1 kilometer	1/1000 of a meter is a millimeter

This method of measuring, called the **metric system**, is now used in most of the world. This system was created by the French Academy of Sciences around the time of the French Revolution. This is a legal system, but has not been required in the United States. The United States is the only major industrialized country that has delayed using the metric system.

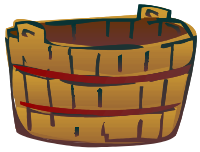
In the United States the more familiar system, using feet and inches, pounds and ounces, is known as the **"customary"** or "inch-pound" system, and originated from the standards brought from England by the early colonists.

HISTORY OF WEIGHTS AND MEASURES IN THE UNITED STATES

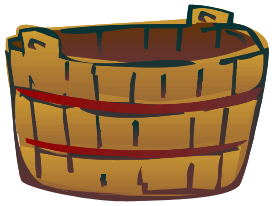
When the colonists came to North America, they brought with them the weights and measures they were used to. This meant there were many different systems of weights and measures. After the American Revolution, the United States had measurements from England, Holland, France, and Spain. This caused a lot of confusion.

To add to the confusion, a measurement unit in one colony did not always mean the same thing in another colony. This meant that a bushel of oats for your horse in the colony of Connecticut weighed 28 pounds, but in the colony of New Jersey it weighed 32 pounds. The farmers were paid different prices for their crops because of the differences in weighing their crops. This was an unfair and unequal system.

Connecticut Bushel
28 lbs.



New Jersey Bushel
32 lbs.



Several early Presidents, afraid that American commerce could be hurt by so many different methods of weighing and measuring, asked Congress to use its power granted in the Constitution to "Fix the Standard of Weights and Measures." Congress did not act on the Presidential requests.

As travel and trade between the states became more frequent and widespread, it became obvious that laws were needed to establish equal and fair systems in weighing, measuring or counting. The laws would make sure everyone received a fair price in buying or selling their produce and merchandise.

HISTORY OF WEIGHTS AND MEASURES IN CALIFORNIA

Early California weights and measures were influenced by measures brought from Mexico and Spain. Explorers first traveled to the California coastline from the Spanish colonial empire of Mexico in the 1540's. The Spanish organized 21 missions and they ruled until 1822, when Mexico won her independence from Spain. California then became a province of Mexico.

The measurement most often used for length was the **"vara"** stick. It was a wood stick that measured between 32 and 35 inches. Because the vara and other measurements were not the same everywhere in California, this caused problems.

THE DISCOVERY OF GOLD

In 1849, gold was discovered in California and the population grew with fortune seekers! This caused new problems and a need for a uniform measurement system. Each mining camp had its own weights and measures laws. There was a need for standard units in measuring land and grain in agriculture and an accurate way in measuring and trading gold.

When California became a state in 1850, one of the first laws was to establish a standard of weights and measures to conform with the standards established by Congress. Copies of weights and measures standards traceable to the National Bureau of Standards were to be distributed to each of the counties in California. This made California's standards the same as the other states within the United States.

How Many Cubits Are You?

Name:_____

Date: _____

Working with a friend, try to figure out how tall you are using the units of measurement from ancient Egypt.

1. Stand straight with your back against the wall. Have your friend mark your height with a very light pencil mark. Measure yourself in feet/inches and write that number down.

2. Measure yourself in the units of measurement used in ancient Egypt. How many cubits tall are you? Write it down in the space provided.

3. Now ask your friend to measure your height in cubits, spans, palms, and digits. Write the answer in the space provided.

4. Have your friend stand with their back against the wall and try the same activity measuring his or her height. Write down your answers.

5. Convert your height to feet and inches.

6. Make sure the charts are complete, and answer the questions that follow.

Your Height in Feet/Inches: _____

	Cubits	Spans	Palms	Digits
Measured yourself				
Measured by your friend				

Your Friend's Name: _____
Your Friend's Height in Feet/Inches: _____

	Cubits	Spans	Palms	Digits
Measured yourself				
Measured by your friend				

How Many Cubits Are You?

7. Was the number of cubits, spans, palms, and digits the same when you measured yourself as when your friend measured you? Explain why.

   _____
   _____

8. Was there a difference when you both measured your friend's height?

   _____
   _____

Story of Weights and Measures Review Questions

Name:_____

Date: _____

Using the Story of Weights and Measures workbook, fill in the blanks below with the best answer.

1. Early units of measure came from _____ and _____.
2. The French's basic unit of length is called the _____.
3. All metric measures of length and distance are based on the meter and the number _____.
4. Early California weights and measures were influenced by measures brought from _____ and _____.
5. A wood stick that measured 32 or 35 inches was called a _____.
6. When California became a state in 1850, one of the first laws was to establish _____.
7. A cubit was the distance from your elbow to the tip of your _____ finger.
8. The "inch-pound" system is also called the _____ System.
9. The width of one finger is called a _____.
10. Twelve inches equals one _____.

Story of Weights and Measures
Review Answers

1. Early units of measure came from **parts of the** body and **people's surroundings**.

2. The French's basic unit of length is called the **meter**.

3. All metric measures of length and distance are based on the meter and the number **10**.

4. Early California weights and measures were influenced by measures brought from **Mexico** and **Spain**.

5. A wood stick that measured 32 or 35 inches was called a **vara**.

6. When California became a state in 1850, one of the first laws was to establish **weights and measures standards**.

7. A cubit was the distance from your elbow to the tip of your **middle** finger.

8. The "inch-pound" system is also called the **Customary** System.

9. The width of one finger is called a **digit**.

10. Twelve inches equals one **foot**.

GLOSSARY

Cubit	The distance from your elbow to the tip of your middle finger.
Customary System	Is a system of measurement used in the United States that originated from England and the early colonists. This system uses feet, inches, pounds, and ounces. It is also called the "inch-pound" system.
Digit	The width of one finger or three grains of barley placed end to end.
Foot	Length of an adult foot. In the Customary System, it is 12 inches.
Meter	A French unit of length based on the number 10.
Metric System	A system of measurement created by the French Academy of Sciences around the time of the French Revolution. All metric measures of length and distance are based on the meter and the number 10.
Pace	A measure used in ancient Rome. Every two steps is a pace.
Palm	The width of four fingers.
Span	The distance from the tip of your thumb to the end of your little finger.
Standard	A unit of measure that everyone agrees to use.
Units	A definite amount of time, length, volume, or weight used as a standard measurement.
Vara Stick	A wood stick that measured between 32 and 35 inches that was used to measure length. It was brought to early California from Mexico and Spain.
Volume	Volume tells you how much space something fills.
Yard	Early English yard unit was the length of Queen Elizabeth I's arm. In the Customary System, it is 36 inches or 3 feet.

Teacher's Resources and References

Training Module One, ***Introduction to Weights and Measures***, California State Division of Measurement Standards. http://www/cdfa/ca/gov/dms

California Foundation for Agriculture in the Classroom, http://www.cfaitc.org/

Michigan Department of Agriculture, Weights and Measures in the Classroom, http://www.michigan.gov/mda/0,1607,7-125-1566_1733-8902--,00.html

Ohio Department of Agriculture, Agriculture in the Classroom, http://www.point-and-click.com/aitc/

USDA's Agriculture in the Classroom, http://www.agclassroom.org/index.htm

Adler, David A., ***How Tall, How Short, How Faraway***. Holiday House, 1999. Introduces several measuring systems such as the Egyptian system, the inch-pound system and the metric system.

Bendick, Jeanne, ***How Much and How Many***. ***The Story of Weights and Measures.*** McGraw-Hill Book Company, Revised Edition, 1989.

Cato, Sheila, ***Measuring (A Question of Math Book)***. Carolrhoda Books, Inc.,1999. A group of children demonstrate how to measure weight, fluids, distance, size, and time.

Gallant, Roy A., ***Man The Measure, Our Units of Measure and How They Grew.*** Double Day & Company, 1972.

Long, Lynette, ***Measurement Mania***. John Wiley & Sons, Inc. 2001. This book provides a variety of games and activities that make math easy and fun.

Pallotta, Jerry, ***Hershey's Milk Chocolate Weights and Measures***, Scholastic, Inc. 2002.